Francis B. Everett

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UNIVERSITY OF ALBERTA
FACULTY OF AGRICULTURE

HOME VEGETABLE GROWING

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UNIVERSITY OF ALBERTA
FACULTY OF AGRICULTURE

Home Vegetable Growing

BY

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Department of Plant Science

with sections on

IMPORTANT VEGETABLE DISEASES AND INSECTS AND THEIR CONTROL

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Distributed by
Department of Extension, University of Alberta
Edmonton, Alberta, Canada

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A QUESTION—Does this publication help solve your problems?

Obviously a short bulletin of this type cannot hope to cover the entire field of Vegetable Production and Marketing. Its main purpose is to outline the general principles of vegetable gardening and to do so as clearly and concisely as possible. The Index on the opposite page is there to be used, and it should help as a ready reference to specific points of interest in the booklet. If the reader has any suggestions that will enable reprints or new bulletins to be more usefully constructed for easier or more valuable reference, the authors, the Extension Department or the members of the Committee on Agricultural Extension and Publications will be gratified to learn of them.

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Home Vegetable Growing

BY

R. J. HILTON

More than 95 percent of rural and urban Alberta householders grow some of their own vegetables. For this reason alone, the production of food in the home garden is of very great importance—as important to the general economy of the Province as it is to the pocketbook of the individual—and it is conservatively estimated that the produce from an average-sized, well-kept garden may be valued at one hundred dollars or more. After all, it does not take such a large supply of bunched radishes, fresh peas, beans and corn, tender new beets and carrots, lettuce and clery—to mention only a

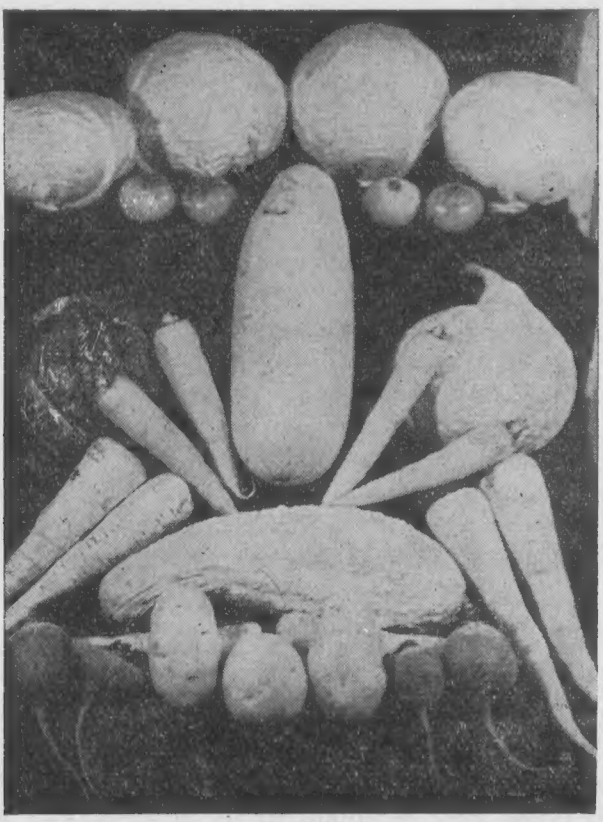

Fig. 1.—A good collection of staple garden produce. All these and many other kinds contribute to the value of the home garden.

few of the valuable garden residents—to surpass this value, as any householder who *has not* a vegetable garden can testify.

Dollars and cents alone do not tell the full story of the home garden values, for well-authenticated trials over a long period have established another fact; that the garden-fresh vegetable is a more valuable food than its counterpart that has spent some time in the market stall or loafing about on the grocer's shelves. *All* the common vegetables contain some quantity of the important vitamins A and C, as well as varying amounts of the vitamin B complex, that contains riboflavin and niacin compounds.

Green-coloured vegetables, especially leafy ones, are particularly good sources of Vitamin C, and if the gardener has foresight enough to lay by a goodly store of canned vegetables, fresh picked immediately before canning, then much of this valuable store of vitamins and vim may be saved for year-round consumption.

In several Alberta towns and cities, facilities for quick-freezing fruits and vegetables now are available to the public, and for a reasonable fee, the gardener may have his own produce quick-frozen, then stored in a cold locker. From this locker, vegetables such as spinach, peas, beans, asparagus and corn will be garden-fresh delicacies until the hoeing season returns.

LOCATION, SOIL AND FERTILIZER

Where to Put It?

The home garden site, or location, may be a matter of necessity rather than choice. In urban house-lots particularly, a location bounded by children's play area, boundary fence, garage and perennial flower border may be the only space available. In this case the gardener must do the best he can to see that this soil is kept "in good heart" and as suitable as possible for his vegetable plants. Country homes usually have far more choice in the matter of location, and frequently have a large-enough area enclosed by shelterbelts to permit some rotation of crops and an occasional resting period. During this period the land is not expected to produce intensively cultivated garden crops, but may lie fallow, or be seeded to grain or clover if moisture is adequate.

The Soil

Very light, or very heavy "stiff" soils are to be avoided whenever possible, although the former may be useful for early, quick-maturing crops if the fertility is kept high. In any case, even these extreme soil types may be modified by good garden practice—for example by plowing under granulated peat, well-rotted manure and green manure crops such as oats or rye—to a point where they

may be reasonably suitable for vegetable production. Other "soil amendment" practices include the use of ground limestone on acid soils, and the use of gypsum and free sulphur on grey-wooded and very alkaline soils respectively. Information about the soil type in any particular locality, as well as suggestions regarding the likelihood of soil amendments being necessary, may be obtained from the Soils Department, University of Alberta, Edmonton, or from the nearest Dominion Experimental Station. The latter are located at Beaverlodge, Lacombe and Lethbridge.

Photo courtesy Dominion Experimental Station, Lethbridge, Alta.

Fig. 2.—Furrow irrigation of potatoes at Lethbridge, Alberta. Usually two such irrigations during the growing season are adequate for good crops of high quality tubers. The soil must be rich to produce heavy crops regularly.

Fertility is Important

Fertility of the garden is maintained by the addition of animal manures, vegetable refuse and straw, commercial fertilizers (chemi-

cals), and by conserving the fertility already present in the soil. Gardens that have been cropped for many years without much fertilizer returned to the land are likely to become low in phosphorus, nitrogen and potassium—usually in the order mentioned. Stable manure is a very satisfactory material to apply to soils, for it is a good source of organic matter, as well as a supplier of nitrogen and potassium; therefore it improves both the physical and the chemical nature of the soil. For most Alberta gardens additional phosphorus should be added in the form of superphosphate to supplement the small amounts that are present in animal manures. The stable dung may be added at rates of six to twenty tons per acre depending upon supply and need. Superphosphate at 200 to 300 pounds per acre should be ample, while a fertilizer such as "ammo-phos"—ammonium phosphate 11-48—may replace the manure and superphosphate applications when applied at 100 to 200 pounds per acre. Transforming these acreage applications to terms suitable for small gardens means superphosphate applications of 5 to 8 pounds per 1000 square feet and "11-48" applications of 2½ to 5 pounds for the same area.

Caution: Poison!

A word of caution in the use of all chemical fertilizers: if they come in contact with tender plants or germinating seed, damage usually will result. Hence, they should be broadcast over the area and mixed with soil by raking or harrowing, or they may be sown close by the seeds or plants (about two inches away) so that the plant roots will find the nutrients as soon as they begin to establish themselves.

PLAN YOUR GARDEN—AHEAD OF TIME!

A bit of forethought and care in planning the layout of your garden—and not forgetting where you have hidden the plan when planting time arrives!—will mean that seed may be ordered in the right amounts, the garden area will be most efficiently used, the proportion of the various types of vegetables will be balanced, and you will have a permanent record of the *position* of the plantings from year to year, so that the practice of changing the location of the different vegetables may be followed season after season. Thus you may practice a form of crop rotation even on a very small garden plot by planting peas where cabbage and cauliflower were grown *last* year, and where root crops will be grown *next* year.

Succession Cropping is Useful

The length of growing season, the space required by mature plants, the location of the perennial vegetable beds, the possibility

of using "succession crops" in any one season, all these are points to be considered in planning the garden. Rhubarb and asparagus may be completely separated from the main vegetable plot, or at on side of it. Short season crops such as radish, lettuce, early cabbage, etc., may be grown quite close to vine crops (cucumbers, squash, etc.) since they will be out of the way before the latter have spread widely. Late cabbage, cauliflower and Swede turnips will require more room than their earlier counterparts, and by careful planning, succession crops such as radish may be arranged, followed by transplanted head lettuce, in turn followed by winter cabbage.

STARTING PLANTS AND TRANSPLANTING

The essentials for the control of watering and of other growing conditions are (1) a good watering can, (2) a well-made hotbed and cold frame, and (3) a fertile transplanting soil that has sufficient sand and organic matter for aeration, drainage and moisture-holding capacity. Plants that are usually (or frequently) started indoors in early spring (for field transplanting later, after danger of frost is past), are tomato, cabbage, cauliflower, Brussels sprouts, broccoli, egg plant, lettuce, celery and onion. Other garden crops that may be transplanted if exceptional care is taken to leave a lump of soil about the undisturbed roots include the "vine"crops, such as cucumber, squash, muskmelon and watermelon.

Starting Plants Under Glass

Seeds are sown in plant pots or wooden boxes (flats), and the initial seedling growth may take place either in a sunny house window or in a greenhouse or hotbed. Small greenhouses may be heated directly with coal, wood, gas or oil heaters, or by hot water or steam, while hotbeds are heated by well-soaked and tramped horse manure, and also by steam pipes or electric cables. If manure is used for making the hotbed, it should be tramped in place at least two weeks before the bed is to be used in order that the initial intense heating period with toxic ammonia fumes will be past before the young plants are exposed to these conditions.

"Pricking Out" the Seedlings

When the young plants are showing their first true leaves, they are ready for transplanting to other containers, and for this purpose flats of a standard size (about 18″×12″×3½″) are universally used. This shifting process is known as "pricking out", and the plants are set at 1½×1½ inches or 2×2 inches, depending upon the type of plant, and the amount of hotbed space available. A mixture of two parts composed soil to one part of sand is excellent

for growing on the pricked out plants—the composted soil being made up the previous year from good garden loam, rotted stable manure and any easily rotted plant refuse such as lawn clippings and tree leaves.

Fig. 3.—Cold frames protected by lath or cloth covers are useful for many propagating purposes in the home garden. When well supplied with manure, they are ideal for raising tomatoes, melons and cucumbers.

Plants Must be "Hardened Off"

When frost danger lessens, the thrifty young plants are "hardened off" by gradually reducing the moisture supplied to them, and by increasing direct exposure to both day and night temperatures. Then they are transplanted to the field or garden, care being taken to place them as deep or a little deeper than they grew in the flats, and to firm the garden soil about the roots so that no large air pockets will interfere with the rapid re-establishment of good feeder-root connectians with water and nutrient supplies in the soil. "Hardening off" effects are not applicable to tender tomato and vine crop plants.

FIELD SEEDING DIRECTIONS

Sowing seeds in the garden, as is usually done with such vegetables, as peas, beans, corn, late lettuce, late cabbage, beets, carrots and other root crops, seems a simple enough procedure. However, unless certain principles are kept in mind, mistakes can

be made quite easily. For instance, if beans are planted too deeply —2 inches or more—while the soil is still cold and wet, the seed will decay before *temperature* and *oxygen* conditions are satisfactory for strong germination. On the other hand too shallow planting in warm, dry weather may mean no seed germination for ten days or perhaps much longer, until a rainfall or irrigation permits the necessary moist conditions.

Fig. 4—Where moisture is a limiting factor, wide spacing of rows may be necessary, as here with onions, beets and other vegetables.

Keep in mind that seeds require optimum conditions of temperature, air (oxygen), and light, before they will germinate, and try to arrange your planting time to conform to these conditions, or vice versa, if artificial watering facilities are available.

GENERAL CULTURAL AND STORAGE PRACTICES

One of the most necessary garden practices is that of cultivation. This begins, of course, by thorough soil preparation before the seeds are planted, in order to ensure a uniform "consistency" of the topsoil so that moisture is evenly distributed, and so that germinating seed and young transplants will have enough air about their underground parts without the air spaces being too large. The latter condition is to be found when a clayey soil "bakes" and breaks into large lumps when it is cultivated, rather than crumbling to a fine-particled "friable" state.

Down with Weeds—by Cultivating!

Cultivation continues after the garden is seeded, chiefly in order to control weeds. In most gardens, Enemy No. 1 is the weed, and the easiest and most logical manner of controlling its growth amongst the rows of *desirable* garden plants, is by means of hoeing, raking, and the use of hand, wheel, motor and horse cultivators. In addition to weed control, the loose nature of the topsoil caused by cultivation allows ready entry of rain or irrigation water greatly reducing loss by run-off.

Fig. 5.—Notice how these annual weeds are competing with the young carrot plants (weeded rows on right). Weeding at the proper time will conserve moisture and avoid serious setbacks.

Frequent cultivation, especially after rains and artificial watering, will keep weeds under control and allow earliest and most rapid development of garden crops with the least really "hard" work on the part of the gardener.

For Winter Use

Most kitchen gardens are planned on a large enough scale to permit some "left over" produce when autumn frosts occur, either in the form of attractive rows of canned vegetables, in the basement cupboard, or by actual storage of the fresh produce. Fortunately, many of the staple vegetable sorts may be stored fresh for quite a long period, providing a few facts are kept in mind. These may be listed as follows:

1. Grow some varieties that are known to be good winter "keepers".
2. Remember that all vegetables, like the plants that produce them, are alive. They will continue their life cycle of gradual respiration and the production of carbon dioxide while they remain usable, and conditions favoring the slowing-down of this respiration are those that give longest storage life.
3. Briefly, such conditions involve some control of temperature (within limits of 32 and 40 degrees Fahrenheit, if possible), and of air humidity (which should be high for all vegetables but onions and vine crops, and even for these it should be fairly high).
4. Under ordinary household conditions, these requirements are not easy to fulfill, especially in a house having a furnace in the basement. However, a small room or cupboard, tightly partitioned off (and insulated) and with moist sawdust or peat moss on the floor and a controllable cool air inlet from outside, often gives very satisfactory results.

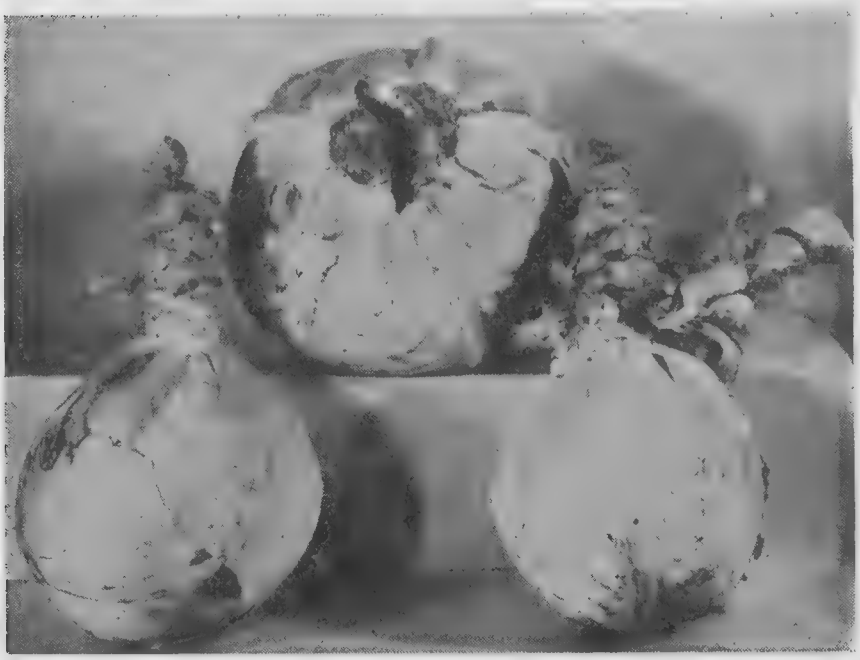

Fig. 6.—When storing cabbages for winter use, leave stems on the head. Note how any growth in storage takes place at nodes along the stem, rather than splitting the head, as has happened with the upper specimen.

HOW and WHAT to PLANT

Bulb Crops

Of these are onions, leeks and garlic, but onions are by far the most important for prairie farms. Suitable varieties of onions are Early Yellow Globe, Red Wethersfield, Southport, White Globe, Early Grano, Sweet Spanish. These are all well-known sorts, but new varieties are constantly being developed, and many of these are worthy of trial under Alberta conditions.

Onions may be grown from seed sown in the open ground, from plants started under glass, and from "sets" grown the previous year. Commercially, the first method is preferred because of its low expense, but in a small home garden plants started early under glass, or grown from sets, will ensure earlier and larger bulbs. Seeding outside is done in late April or May, or occasionally in very late autumn, just before the ground freezes. The seed is drilled into rows 12 to 15 inches apart, and the plants thinned to three inches in the rows. Plants closer than this will mature earlier, but will be smaller and more uneven in size and shape. Seed sown

Fig. 7.—Four leading onion types that do well in Alberta. These may be planted outside early in the season, or grown from transplanted seedlings that are started under glass.

indoors in flats during late March gives plants that may be hardened off in mid-May, and if the plants are well grown, there will be a gain in bulb size by the early fall in comparison with outside seeding. The plants should be root and top pruned lightly at transplanting time, and particular care should be taken to set the plants shallow enough so that the bulb is not buried more than one-quarter inch, if at all. Thus the plant bed should be quite firm at transplanting time so that the slender plants do not become accidentally buried too deeply. For extensive onion plantings the garden or lawn roller often is used to firm the soil. Onion sets are set out in early May, usually earlier than seedlings may be transplanted.

Onions, leeks and garlic plants require frequent hoeing and hand cultivation to keep weeds down. By late August or early September the onion tops should be starting to fall, and this is a sign of approaching maturity. When the tops have all fallen to one side, the bulbs are pulled and left in the field in windrows to dry for a week or ten days. Or they may be taken to a dry airy shed or attic room and dried there. They are topped and stored in slatted crates in a dry, moderately warm and well-ventilated room for a month or so, then stored for winter use in a cool, dry cellar. Continue to store in shallow slatted crates, as these allow best ventilation.

Leeks and garlic are seldom seen in the home garden, but are worth growing for food flavouring purposes, and their general culture is similar to that of onions.

Salad Crops and Greens

Lettuce, spinach, Swiss chard, kale and celery are the most important of these crops, although cabbage is frequently used as a salad crop, and young table and sugar beet tops for greens. Dandelions, too, are a commonly used "greens" plant, but seldom require special encouragement in the garden!

Lettuce types are classified with recommended varieties in brackets: *leaf lettuce* (Grand Rapids), *crisp head lettuce* (Great Lakes, New York, Iceberg), *butterhead lettuce* (Big Boston), and *cos lettuce* (Trianon, White Paris). Cos lettuce is also known as Romaine lettuce, and is later than other types, and has a distinctive flavour. Lettuce often is seeded under glass and transplanted to the field in early May, but except for earliness, this procedure is unnecessary. The young plants are quite hardy, and seed may be planted out of doors as soon as the land can be worked. Place the rows 15 to 20 inches apart, and thin leaf lettuce at 4 to 6 inches

in the row, and head lettuce to 8 inches apart. Head lettuce will go to seed quickly in hot weather, so succession plantings can be made to maintain a supply over a period of several weeks. Summer heat is not conducive to lettuce growing, as it is a cool season crop as well as a short season one. Moist and rich garden conditions are best for this crop, as well as for all other salad crops.

Fig. 8.—Lettuce of all kinds and varieties responds very well to transplanting from the cold frame, in Prairie gardens.

Spinach varieties that are suitable for garden culture include King of Denmark and Long Standing Bloomsdale. This plant is a relative of the garden beet, but is grown for its vitamin and mineral-rich green leaves, and these may be harvested only a few short weeks after sowing the seed in early spring. Since spinach plants send up seed stalks readily in warm weather, succession planting is desirable. New Zealand spinach is an entirely different plant, but is used for the same purpose. Seed in early spring, and thin the plants to 12 inches apart. Pluck the individual leaves as required for greens, and thus obtain several "pickings" from each plant.

Swiss Chard is a member of the beet family, and is perennial in warmer climates, but may be grown as an annual in Alberta. The tender beet-like leaves are picked and cooked as greens. Lucullus is a standard variety, and the seed should be sown in the garden in early spring, and the plants thinned to 8 or 10 inches in the row.

Kale or Borecole is not widely known. It is closely related to cabbages, but has crinkly, curled leaves that are green or purple in color. The plants are very hardy, but even so usually will not stand prairie winters, hence it is suitable only as an annual. It does provide a very useful source of fresh greens in late autumn, when all other garden plants have perished. Tall and Dwarf Scotch Curled are two recommended varieties.

Celery growing is more painstaking than most other vegetable crops, but is worth the extra effort for those with space available and a real interest in gardening. This is a tender, long-season crop, so seed should be sown indoors in March, and after a period in hotbed and coldframe, the young plants should be transplanted to the garden in early June, at 6 to 8 inches apart in rows 36 to 40 inches apart. Self blanching varieties such as Golden Self Blanching and Easy Blanching are useful, with Giant Pascal and Utah as winter sorts, to be stored with roots in moist soil for winter blanching in the cellar. Garden blanching is done in August by using boards, building paper or soil against the plants. A form of culture that assists self-blanching is to grow celery in beds about five feet wide (6 rows), so that only the outside of the rows on the edges of the bed require special blanching. Celery plants sometimes are set in trenches in the garden, the soil gradually being filled in as the plants grow. This allows good blanching, but is rather painstaking.

Root Crops

Radishes, carrots, beets, Swede turnips (rutabagas), summer turnips and parsnips all are well-known home garden root vegetables, and valuable for nutrition as well as variety in the diet. Radishes are the shortest season crop we grow, but except for the little known "winter" varieties, they do not keep long and grow to best advantage during the cool spring weather. By far the most common type is the "globe" or "round" radish, and the Scarlet Globe, Sparkler and Saxa are common standard sorts. An oval or "half-long" type is the well known French Breakfast variety. White Icicle, a "long" type, is prized for its sharp, fine quality, and is not so likely to become "woody" in early summer as are the earlier "globe" varieties. Winter varieties are Black Spanish and Rose China. These may be seeded in late June and harvested in the fall.

All the root crops for winter storage require similar garden culture. All are seeded direct into the field, thinned to a suitable distance after germination, and kept free from weeds until harvest time. The smaller the roots, the more closely together the plants may be left; thus carrots and beets need only to be thinned to two inches apart, parsnips to three, and Swede turnips should be from

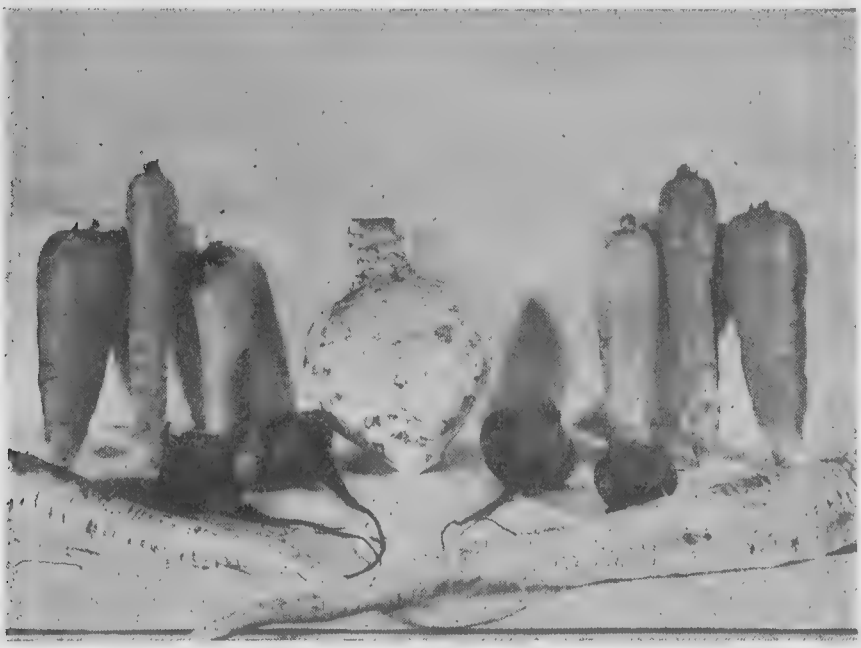

Fig. 9.—Root vegetables for every dining table. All these succeed very well in Alberta, under suitable moisture conditions.

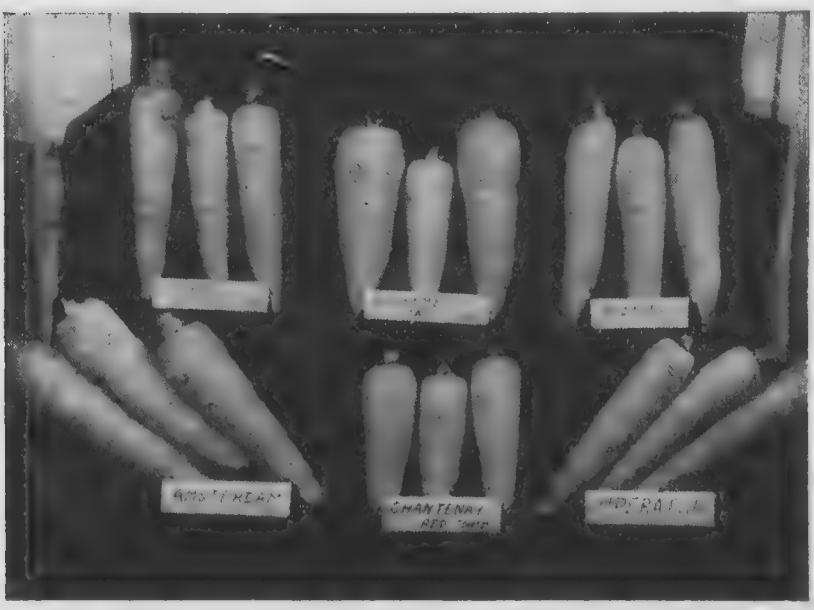

Fig. 10.—Here are six types of garden carrots. Danvers and Chantenay are most commonly grown, but Nantes is an excellent home garden variety of high quality.

ten to twelve inches apart. Rows in general are 30 to 36 inches apart, but may be much closer if hand cultivation only is practised, and if irrigation or a garden hose is available. Parsnips germinate slowly and require a long growing season; therefore they should be planted early in the spring. Other root crops will provide better quality roots if they are planted no earlier than early June, and are allowed to grow rapidly in the fall. For summer use, however, succession plantings of carrots, beets, and summer turnips may be made, beginning in very early spring.

Tested varieties of root crops for prairie gardens should include:

Carrots—Chantenay, Nantes and Imperator.

Parsnips—Guernsey, Hollow Crown.

Beets—Early Flat Egyptian, Crosby Egyptian, Detroit Dark Red.

Summer Turnips—Early Milan Purple Top, Early White Milan.

Swede Turnips—Ditmars (Bronze Top), Wilhelmsburger (Bronze Top), Laurentian (Purple Top).

Cole Crops

Crops of this group most commonly grown in Alberta are cabbages and cauliflowers. Broccoli and Brussels sprouts also are worthy of trial in the home garden, and add variety to this oft-maligned but valuable "cabbage" family. Early varieties of cabbage and cauliflower will mature satisfactorily if the seed is sown out of doors in early spring, but for most satisfactory results it is customary to start the plants indoors, as outlined in a previous section. All plants of this group are very easily transplanted, but "sprouting" broccoli and Brussels sprouts should be started early to ensure maturity in the short prairie season. Heading broccoli is similar to very late cauliflower, but sprouting broccoli forms a long loose head of flower buds, and will re-sprout new heads when the old ones are harvested, so may give a continuous group for several weeks. Good cole crop varieties are:

Broccoli (heading)—Large Early White French.

Broccoli (sprouting)—Italian Green Sprouting.

Brussels Sprouts—Dwarf Perfection Improved, Dalkeith.

Cabbage:

early—Golden Acre.

mid-season—Copenhagen Market.

late—Danish Ballhead, Penn State Ballhead.

Cauliflower—Early Erfurt, Snowball, Snowdrift.

Legume Vegetables

Peas and beans belong to this very important legume family, and constitute one of the most widely grown vegetable groups in the temperate climates of the world. Their culture, in general, is familiar to all, but it must be borne in mind that (1) whereas peas are hardy and will stand considerable frost, beans are very tender and if planted before frost danger is over, may have to be replanted; (2) peas grow best during cool, moist weather, whereas beans tolerate (and indeed, require) warmer weather for maximum growth; (3) beans are much more subject to foliage and pod disease during damp cool weather than are peas; and (4) a succession of maturity with both beans and peas may be secured either by succession plantings or by planting varieties of early, medium and late maturity.

Plants of these legume vegetables are always grown from seed planted directly out of doors, and in general, spacings of plants at 1½ to 3 inches in the row, with rows from 24 to 36 inches apart, are desirable. The earliness, mature size, soil fertility and availability of water are the factors determining the spacing of plants and rows.

Home gardeners have a wide choice of acceptable varieties of peas and beans, but the following list has been found to be satisfactory for most Alberta gardening conditions:

Peas:

early—Little Marvel, Premium Gem.
medium—Laxtonian, Lincoln, Laxton's Progress.
late—Tall Telephone, Stratagem, Onward.

Beans:

snap—Asgrow Stringless Green Pod, Tendergreen, Round Pod Kidney Wax, Golden Wax.
pole—Scarlet Runner, Kentucky Wonder Wax, Blue Lake.
shell—Pacer, Princess of Artois, Alberta Brown.
broadbean—Broad Windsor, Longpod Hangdown.

Vegetable Fruits

These may be subdivided into the Solanaceous crops—tomato, eggplant and pepper—and the Cucurbits, or vine crops—cucumber, squash, pumpkin, muskmelon and watermelon. Gourds, gherkins and citron melons also are cucurbits, but seldom are grown in Alberta. These plants all have in common that the fruit is used for food purposes, and another common requirement for their successful growth is that they all are very tender to frost and all require rather high summer temperatures for optimum growth and fruiting.

Fig. 11.—An "indeterminate" tomato plant. These should be pruned to one stem and staked, with about five clusters allowed to set fruit.
Photo courtesy Dominion Experimental Station, Morden, Man.

Fig. 12.—"Determinate" or "bush" tomato varieties, as grown at Morden, Manitoba. These plants need no pruning.
Photo courtesy Dominion Experimental Station, Morden, Man.

Tomatoes.

The *Solanaceous plants* are usually started indoors, later being transplanted and moved from hotbed to coldframe and to the garden in early June, when frost danger is past. Except in certain parts of southern Alberta (see zones 2 and 3 in the Horticultural Zonation Map), it is not possible to count upon much plant-ripened fruit from the so-called "indeterminate" tomato varieties, or from egg-plants and peppers. However, with facilities such as a greenhouse or a good hotbed, plants of indeterminate varieties such as Earliana, Bonny Best and Abel may be brought to ripen a fair crop of fruit outside, if started early and pruned to a single stem. Pruning consists of pinching out all side branches that form, leaving only the blossom clusters and leaves attached to the main stem. The single stem is loosely tied with raffia or twine to a sturdy stake (1″ to 1½″ diameter) that is driven into the soil beside the plant. The disadvantages of pruning are that it is laborious, requires more plants per unit of land and sometimes results in a higher proportion of fruits affected with blossom-end rot and cracking. In a small garden, however, the cost of the extra plants is not likely to be high and the practice does result in an increase in vine-ripened fruit. A decrease in the total yield per plant may be expected from pruning, but this is offset by setting the plants to be pruned much more closely together than unpruned plants. The latter usually are set at 3½ x 4 feet or 4 x 4feet, whereas 2 x 4 feet is ample space for pruned plants.

Of recent years certain tomato varieties have been developed that have a growth habit known as "determinate" or self-pruning. After a certain number of fruit clusters have set fruit, the growing

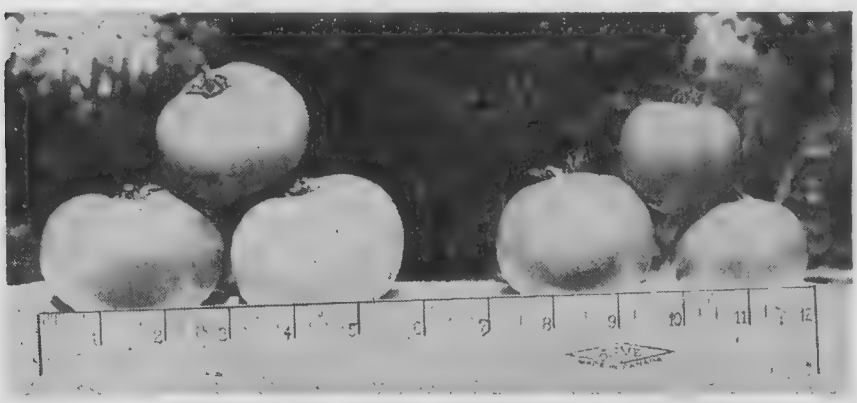

Fig. 13.—Two desirable tomato strains, developed on the Prairie for Prairie gardeners. Special care must be taken in Northern areas before fruits like these can be ripened.

Photo courtesy Dominion Experimental Station, Morden, Man.

points cease further growth, thus making laborious pruning unnecessary. Fortunately for Alberta gardeners, several good determinate varieties are early and of acceptable colour and quality for home consumption.

Recommended tomato varieties for trial in Alberta gardens are:

Indeterminate (Prune and stake)—Abel, Earliana, Bestal and Princess Mary.

Determinate (self-pruning)—Early Chatham, Bounty, Farthest North and Lethbridge 3700.

A sweet, yellow-fruit variety of this class is Golden Bison.

Eggplants and Peppers.

The culture of eggplants and peppers is very similar to tomatoes, but it is more difficult to obtain ripe fruit, since they are longer season crops than many tomato varieties. Eggplants are set from the coldframe at 2 x 3 feet and peppers may be set at 1 x 3 feet or 1½ x 3 feet. Both these vegetables should be transplanted in plant bands or with a good ball of soil on the roots, and should not be checked by over-watering. They prefer hot, dry conditions and a rather light loam soil. Black Beauty and Blackie eggplant varieties are reasonably dependable in the southern irrigation districts, while Harris Earliest and Hungarian Yellow peppers warrant trial as far north as Edmonton at least.

True Annual Vine Crops.

Cucurbit plants (the true vine crops—pumpkin, cucumbers, etc.) are warm weather crops, and in most seasons they should be started in the green house or hotbed about the first of May, to be transplanted to the garden early in June when the soil warms up. To transplant these succulent and temperamental plants successfully, by far the most convenient method is by means of plant bands. These bands are made of wood veneer or specially impregnated paper, and are set close together in a wooden flat, and when they are filled with soil one or two seeds are sown in each band. At transplanting time the whole band (soil, plant and all) is set firmly into the prepared seed-bed, so that the young plant never has its root system disturbed.

After transplanting, if the soil and atmosphere are relatively cool, or if frost threatens, it is often useful to place waxed-paper covers (Hotkaps) over the plants for 10 days to two weeks.

In the irrigation districts of the province, squash, pumpkins and cucumbers usually succeed when sown directly out of doors about May 20th to May 25th. Recommended practice is to allow 8 x 8 feet

Fig. 14.—Early Canada Watermelons—uniform in type and size, and of fine quality.
Photo courtesy Dominion Experimental Station, Morden, Man.

for each hill of three plants of vine-type squash and pumpkins, although bush-type squash hills are planted at 4 x 6 feet. Cucumbers and mushmelons are set at 3 or 4 feet by 6 feet, if in hills, or 2 x 4 feet if single plants are used. As a rule it is not advisable to attempt muskmelon and watermelon growing unless special facilities are available, such as glass protectors (or a used hotbed), and very sunny location. All cucurbits benefit from rich, light soils in the sunniest possible location.

Varieties recommended for trials are as follows:

Cucumber—Delcrow, Straight 8, Mandarin.

Cucumber (pickling) — Mincu, Early Russian, National Pickling.

Muskmelon—Chipman's Champion, Farnorth, Extra Early Hackensack.

Pumpkin—Early Cheyenne, Sugar.

Squash (small) —Buttercup, Table Queen, Kitchenette.

Squash (large)—Green Hubbard, Golden Hubbard.

Watermelon—Early Canada, Cole's Early, Honey Cream.

Potatoes

For a crop of such vital importance, not only to the large commercial grower but to every home gardener as well, a special section is in order. Strictly speaking, the potato belongs to the Solanaceous plants, along with tomatoes, eggplants and peppers. However, its important place in the home diet, and the fact that the enlarged stem, rather than the fruit, is the edible part, should be sufficient justification for placing it in a separate discussion classification.

The culture of the potato needs little consideration here, being familiar to all gardeners. However, a few hints on securing early yields for the summer crop may be of interest. First, secure seed-tubers of disease-free stock. This is best assured by purchasing from containers bearing the label "Certified Seed Potatoes". For summer use the seed pieces (or "sets") should be cut about four to six weeks before normal out of doors planting time, and placed in moist sand to sprout and send forth roots. Ideal conditions are found when the seed piece is not quite covered with sand, and when

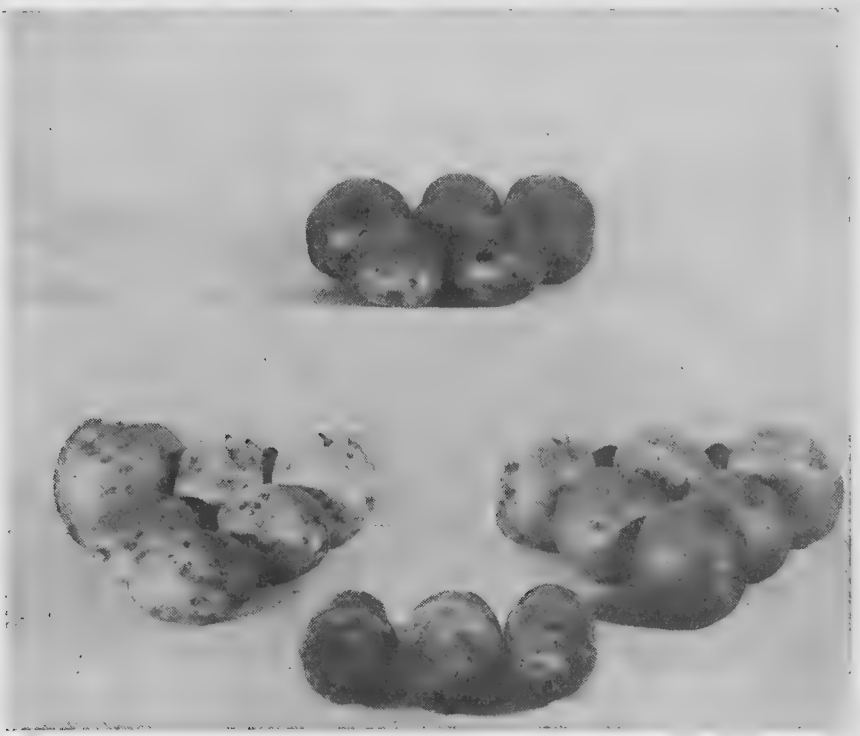

Fig. 15.—Potato types commonly grown:
Upper—Oval-long, early, semi-netted variety (Early Dewey).
Left—Round-oval, smooth, late, white variety (Canus).
Right—Round, white netted seedling variety (C-16).
Lower—Long, late, white netted variety (Netted Gem).

the starting boxes are placed in a moderately cool room (ranging from 50° to 70° F.) and in indirect light. This is secured near many basement windows.

The sprouted and partially rooted plants are transplanted to the garden early in May and covered lightly with soil. If frost threatens the shoots when they emerge, they should be covered again with soil.

For larger plantings of early potatoes where setting rooted plants is too laborious, the seed tubers will benefit from "greening". This is done simply by exposing the tubers to moderate light at "living-room" temperatures for two to four weeks prior to planting. This practice will not encourage root growth, but each eye on a healthy potato will form short green-purple shoots of sturdy character, and when seed pieces are cut from "greened" tubers, they will start quickly after planting and be ready for harvest a few days before those that were not so treated.

Tests have established that seed pieces of one to two ounces weight give most efficient results, although satisfactory crops often may be grown from ½ ounce "eye-pieces", as well as from whole tubers of four to eight ounces.

Light hilling of the plants should be done in order to provide enough soil cover to prevent sunscald and its resultant green, bitter tubers.

If moisture is plentiful, potatoes on rich soil may be spaced at 12 inches apart in rows 30 inches apart. Where moisture may be a limiting factor, spacings of 15 inches in rows of 36 inches apart is recommended.

Varieties:

Early—Warba, Carter's Early Favorite, Vick's Early.
Mid-season—Irish Cobbler, Early Ohio.
Late—Netted Gem, Wee MacGregor.

Sweet Corn

The advent of high quality, early maturing sweet corn varieties has resulted in pushing the boundary of its successful culture far to the north. Production of even earlier hybrid varieties promises to further enlargement of the areas where home garden corn production is possible.

This member of the grass family is a warm weather crop, so rapid growth and quick maturity during July and August are very necessary in the Alberta climate. For this reason, in most growing areas, only varieties that will mature ahead of Golden Bantam should be considered.

Corn seed is planted in drills (seed at 6 inches apart) or in hills (three plants in a hill every 30 to 36 inches) and the rows at 30 to 36 inches apart, depending upon availability of moisture and the richness of the soil.Seeding should be done about mid-May, and frequent but light cultivation given the crop. This plant has feed-

Fig. 16.—Young sweet corn plants in hills, making good growth in the Horticultural Gardens, University of Alberta.

ing and support roots very near the soil surface, so deep cultivation should be discouraged after the plants are 12 inches high. When the silk has turned brown, examination of ,'plump-feeling" ears should show them to be well filled and well colored, and at this "milk-stage" the ears are most desirable for table use.

Since corn plants depend upon the wind for pollination, the garden plot should be of several short rows, side by side, rather than one long row. This will ensure pollination, no matter from which direction the prevailing winds may be.

Varieties generally suitable from Edmonton to the southern border are:

Early—Banting, Dorinny, Golden Gem, Sugar Prince, Altagold.
Mid-season—Seneca 60, Golden Early Market, Spancross.

In addition to the above, Golden Bantam, Burbank Golden Bantam, and Topcross Sunshine have been found suitable for the irrigation areas from Brooks southward.

Perennial Vegetables

Most important in this group are asparagus and rhubarb, although horse radish and Jerusalem artichoke are less well known perennials.

Asparagus is not a difficult crop to grow, the chief drawback to its cultivation in the home garden being the time necessary to establish a bed of this early spring vegetable. One-year strong plants are set at 18 x 48 inches, and with the crown buds at six to eight inches below the ground level. Planting less deeply will result in damage to the young crowns at cutting time in later years. A brief (two weeks) cutting may be made in the second year if the plants are vigorous, but a full six to eight week cutting season should not be expected before the fourth year.

Harvesting the tender tips is done with a sharp knife, the cut being made about one inch below the ground level. Fertilizing with 11-48-0 at 200 lbs. per acre immediately after the final spring cutting will promote strong plants, and light manuring in the late fall as soon as the dead tops are removed will maintain the bed in healthy condition. Under no circumstances must the tops be cut back during summer and fall while they are in green growing condition. Mary Washington is the most widely grown variety.

Rhubarb, like the lowly radish, has a common and yet very special place in the home garden. Every household should have at least half a dozen hills of this spring table delicacy. This plant prefers a rich, deep loam, as does asparagus, and manure should be used freely and annually, preferably as a late autumn mulch, to be spaded in about the plants in the spring. As with asparagus, early spring growth depends upon the plant foods manufactured the previous year and stored in the roots over winter. Hence, overcutting and late cutting should be avoided.

Propagation may be from seed, but the division of the crowns into root-piece containing an "eye", or bud, is the preferred method. The bud of the division is placed at ground level and the plants are set at four feet apart each way, although in a small garden they may be set a little more closely together.

Ruby, Macdonald, Valentine and Early Sunrise are excellent quality varieties, and the first named three are suitable for indoor forcing during the winter. For this purpose whole roots are lifted and allowed to freeze until mid-November or later. Thereafter they may be stored in a cold basement until forced. This is done in a dark cellar at temperatures of 50 to 60 degrees Fahrenheit. Soil or sand is banked about the roots and moderate watering is practiced until harvesting is complete.

Horseradish is propagated by means of root cuttings and these may be three to six inches in length by one-half inch in thickness. Roots of this perennial, when grated and mixed with vinegar, make a highly prized condiment, and the product so made will keep for several weeks. A danger with this vegetable is that it may become a garden nuisance if not kept in check, so vigorously does it spread from broken root pieces. The plantation should be renewed each year, otherwise numerous roots too small for efficient use may result.

Moliner Kren is a widely advertised variety.

Jerusalem Artichoke is a perennial tuberous plant belonging to the sunflower family, and grown occasionally as an orchard cover crop or for green material in chicken and hog yards. The tubers somewhat resemble potatoes and, after early spring setting, are ready for use in late autumn. The cooked vegetable is not highly rated for most Albertan palates and, like horseradish, the plants are dangerous from a weed standpoint, since the tubers usually overwinter and make exceedingly rapid growth in the garden.

Herbs

No home garden is complete without a small patch devoted to herb growing. Those most commonly cultivated are annuals, although some savoury crops such as chives and horseradish are perennial and should be planted on the garden edge or in some out-of-the-way spot where they need not be disturbed except for cultivation and harvest.

Remember that herbs require plenty of sunlight for best development, so after sturdy young plants are started in the hotbed or coldframe, transplant them to a sunny, well-drained location; preferably an area that is not too rich, for they should not grow too rankly. The leaves may be picked from the plants as needed, or stalks may be harvested while the leaves are tender, just before the majority of the flower buds open. These stalks should be plucked when there is no dew or rain on them, and hung to air-dry thoroughly in a warm airy place.

Kinds that may brighten the taste and aroma of many a meal are: ainse, basil, borage, caraway, chives, cumin, dill, fennel, mint, parsley, sage, summer savoury, sweet marjoram and thyme.

BOTANICAL CLASSIFICATION

For those enthusiastic gardeners who would like to know the correct botanical classification for the vegetables they are growing, the following table is given:

TABLE I.

Vegetable	Specific Name	Family
Asparagus	Asparagus officinalis	Liliaceae
Bean:		
Bush snap	Phaseolus vulgaris	Leguminoseae
Pole snap	P. vulgaris	"
Scarlet Runner	P. multiflorus	"
Broad Bean	Vicia faba	"
Beet	Beta vulgaris	Chenopodiaceae
Broccoli, sprouting	Brassica oleraceae var. italica	Cruciferae
Brussels Sprouts	Brassica oleraceae var. gemmifera	"
Cabbage	Brassica oleraceae var. capitata	"
Carrot	Daucus carota	Umbelliferae
Cauliflower	Brassica oleraceae var. capitata	Cruciferae
Celery	Apium graveolens	Umbelliferae
Chard, Swiss	Beta vulgaris var. cicla	Chenopodiaceae
Corn, Sweet	Zea Mays var. rugosa	Gramineae
Cucumber	Cucumis sativus	Cucurbitaceae
Lettuce	Lactuca sativa	Compositae
Melon, Musk	Cucumis Melo	Cucurbitaceae
Melon, Water	Citrullus vulgaris	"
Onion	Allium cepa	Liliaceae
Onion Sets	A. cepa	"
Parsnip	Pastinaca sativa	Umbelliferae
Pea	Pisum sativum var. hortense	Leguminoseae
Potato	Solanum tuberosum	Solanaceae
Pumpkin:		
Vine	Curcurbita moschata	Cucurbitaceae
Bush	C. pepo	"
Radish	Raphanus sativus	Cruciferae
Rutabaga (Swede Turnip)	Brassica Napobrassica	"
Rhubarb	Rheum rhaponticum	Polygonaceae
Spinach	Spinacia oleracea	Chenopodiaceae
Squash:		
Vine	Cucurbita maxima	Cucurbitaceae
Bush	C. Maxima	"
Tomato:		
Unpruned	Lycopersicum esculentum	Solanaceae
Pruned or self-pruning	L. esculentum	"
Vegetable Marrow	Cucurbita pepo	Cucurbitaceae

GENERAL NOTES

In consulting Table II for purposes of seed purchase and planning the garden, several points should be borne in mind. Briefly, these may be listed as follows:

1. Many of the vegetables have a "length of growing time to maturity" that would not allow their being seeded outside and maturing before frost. Hence, they are started under glass and transplanted to the garden as sturdy four to eight weeks old plants.

2. Many vegetables that require such transplanting in order to mature under Alberta conditions may require less seed than stated in the table, for under indoor seeding conditions, there is very little plant loss, and no necessity for plant thinning.

3. Celery plants do best if started about mid-March, but many others (tomato, early cauliflower and cabbage, Brussels sprouts, etc.) should not be started before April 1. Onions, lettuce and main-crop cabbage and cauliflower, as well as cucumbers and squash in plant bands, need not be started until mid-April.

4. The distance between the rows will vary with (a) the type of cultivation (hand, horse or garden tractor), (b) whether artificial watering is practised, and (c) the type and fertility of the soil.

5. Obviously the yield will vary with variety, stage of maturity at harvest, fertility, moisture and other factors.

TABLE II.—PLANTING AND YIELD INFORMATION

Vegetable	Seed per 50′ row	Depth of planting (inches)	Days growth before-use	Plant spacing after thinning or transplanting (inches)	Space between rows (inches)	Expected yield per 50′ row
Beans:						
Bush, snap	½ lb.	1	50- 70	3	24-30	35 lb.
Pole, snap	½ lb.	1	65- 80	4- 6	30	50 lb.
Scarlet Runner	1 lb.	1	75	4- 6	30	50 lb.
Beans, Broad	1 lb.	1	60- 80	5	24-30	50 lb.
Beets	1 oz.	½	50- 80	2	12-24	50 lb.
Broccoli, sprouting	⅛ oz.	½	110-150	15	24-30	70 lb.
Brussels Sprouts	⅛ oz.	½	110-150	15	24-30	20 qts.
Cabbage	⅛ oz.	½	100-130	12	24-30	50 heads
Carrot	½ oz.	½	60-100	2	12-24	100 lbs.
Cauliflower	⅛ oz.	½	100-120	12	24-30	50 heads
Celery	⅛ oz.	¼	110-150	9	12-30	35 heads
Chard, Swiss	½ oz.	½	50- 75	6	18-30	50 lbs.
Corn, Sweet	2 oz.	1	80-120	6- 9	24-36	6 doz. ears
Cucumber	¼ oz.	½	75-120	24-36	30-36	60 lbs.
Lettuce, head	⅛ oz.	¼	60- 80	9	12-24	35 heads
Lettuce, leaf	¼ oz.	¼	50- 75	4- 8	12-24	70 plts.
Muskmelon	¼ oz.	½	110-150	36	36	30 lbs.
Onion, seed	¼ oz.	¼	100-140	4- 6	12-24	50 lbs.
Onion, sets	1 lb.	½	60- 90	4	12-24	60 lbs.
Parsnip	⅛ oz.	½	120-150	3	24-30	50 lbs.
Peas	½ lb.	1	50- 75	2- 4	24-30	50 lbs.
Potatoes	3-4 lbs.	2-4	90-140	12-16	30-36	120 lbs.
Radish	½ oz.	½	25- 50	1	12-24	60 bunches
Rutabaga (Swede Turnip)	½ oz.	½	110-140	10-14	30	100 lbs.
Spinach	½ oz.	½	40- 55	2- 4	18-30	50 lbs.
Squash	¼ oz. to ½ oz.	1	110-140	48-72	60	100 lbs.
Tomatoes, Pruned or Self-pruning	⅛ oz.	¼	120-150	30	30-36	100 lbs. (gr. & ripe)
Vegetable Marrow	¼ oz.	1	75- 90	48	60	100 lbs.

ACKNOWLEDGMENTS

The author has drawn freely upon published bulletins, circulars and text books in compiling the information contained in this bulletin. In particular the following publications have been helpful, and thanks is hereby expressed to the authors.

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2. Vegetables for Prairie Farms, by Leslie and Godfrey. Dominion Department of Agriculture, Publication 663, 1940.
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Control of Vegetable Diseases

BY

A. W. HENRY

Vegetables, like other plants, are subject to disease and on occasion may be severely damaged or even ruined thereby. To avoid disappointments the vegetable gardener is well advised to include disease preventive measures in his production program.

Disease prevention in the home garden may be organized under a definite plan as outlined in the paragraphs below.

USE OF SUPERIOR SEED

Since many diseases of vegetables are caused by seed-borne agencies it is important to avoid infested seed and to use only the best seed obtainable. This cannot be too greatly emphasized in the disease prevention program. If you can grow your own seed and select it for freedom from disease, that may be the best way to insure a satisfactory supply. This may be feasible for a large farm garden, but for the small kitchen garden it is usually necessary to buy your seed. The very best obtainable should be purchased, preferably seed which has been inspected and certified for freedom from disease and which has originated in a district having a good reputation in the production of disease-free seed.

Where vegetables are propagated from bulbs, tubers, cuttings, or other vegetative parts, it is just as important or even more so to use superior plant stock, as when true seed is employed. Thus, in growing potatoes, certified or other superior "seed" should always be planted if one's own "seed" is not dependable.

SEED TREATMENT

Seed treatment should have a definite place in a vegetable disease control program, both for the destruction of seed-borne pests and for the protection of the seed against soil-borne organisms. For the former, surface treatments may be sufficient but occasionally internal disinfection is necessary. For surface disinfection and seed protection, chemicals in dust form such as the organic mercury preparations, Semesan, Semesan Jr., and Ceresan and the less poisonous non-mercury dusts, Arasan, Spergon and Fermate are employed. Where internal disinfection is necessary, hot water is most effective. The latter may be used in combination with a

seed protectant in some cases. If the home gardener has had difficulty with "damping-off" in seedling flats (see Table III), then surface treatment as outlined above may be desirable and even necessary in order to obtain a stand of healthy plants.

SEEDLING PROTECTION

The seedling stage is a vulnerable one. Hence special protection from disease-producing enemies may be necessary during this phase of the plant's life. Chemical seed protectants are helpful for seedlings started inside as well as outside. But seedlings started inside may need additional protection especially from "damping-off". This may be provided by regulating the humidity and temperature of the air, the supply of light and water and the composition of the soil. High humidity, extremes of temperature, excessive

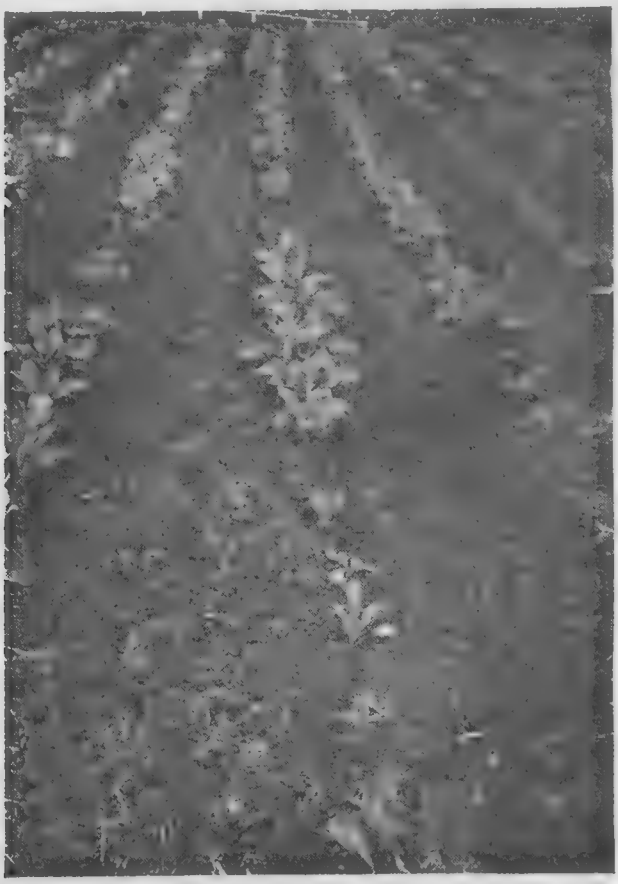

Fig. 17.—Cauliflower plants are particularly susceptible to "Damping-off" disease. They should not be transplanted when the ground is very cold and wet.

shading and watering should be avoided. The soil should be as free as possible from infested debris of the plants to be grown and of related plants. If reasonably free from such material it may be used with comparative safety without sterilization, especially if a thin layer of sand or of screened sphagnum moss is spread over the surface. However, in case of doubt and to be on the safe side, the soil may be sterilized. A simple method for small quantities of soil consists in mixing with the soil a solution made by adding 1 part of formaldehyde to 5 parts of water. The soil is spread out in a thin layer and then sprinkled with this solution at the rate of about ½ pint per bushel of soil. Seed may be sown after 24 hours but transplants should not be set until the odor of formaldehyde has disappeared from the treated soil. It is important to water thoroughly immediately after seeding, although too frequent watering should be avoided.

ROTATION AND CULTURAL PRACTICES

From the standpoint of disease control as well as from the nutritional point of view, it is advisable to practise rotational rather than continuous cropping in vegetable gardening. This will not guarantee a disease-free garden but it will help.

Vigorous, well nourished plants are less likely to be severely damaged by certain types of disease (not all) than weak, impoverished ones. Hence it is well to rotate, fertilize and cultivate in such a way as to encourage this type of growth in the garden. Good cultural practices will also keep weeds under control and this in turn will result in better disease control. Cultivation, however, may at times encourage disease, for example if done when the plants are wet, so should be avoided under such conditions.

PROTECTION OF THE GROWING CROP

Once plants become affected with certain diseases such as the virus diseases they rarely or never recover. It is better to remove and destroy completely such diseased plants as soon as they are detected in the vegetable garden than to attempt to coddle them along. This eradication process, known as roguing, is an important one and should be rigorously practised. It may appear wasteful but will pay in the end as it will help materially to protect the other plants in the garden which may otherwise become attacked by the parasites harboured by the diseased plants.

Chemical sprays and dusts may be used to protect the foliage of vegetables from air-borne pathogens. They may be used to advantage occasionally in the control of leaf-diseases of certain vegetables,

e.g. celery and potatoes. Copper-containing mixtures such as Bordeaux mixture, Burgundy mixture, fixed copper mixtures and copper lime mixtures have been largely employed. Sulphur has been used chiefly in dust form for the control of powdery mildew diseases, and recently several organic chemicals sold under trade names, e.g. Fermate, have shown promise. Make the first application of protective chemicals as soon as the disease is observed or before and follow this with subsequent applications if seasonal conditions warrant them.

The control of insects (see section on insects) in the vegetable garden is also an important protective measure against disease, since insects commonly carry causal agents of disease from plant to plant. In some cases it is advisable to apply an insecticide and a fungicide together for most economical protection.

GENERAL SANITATION

General cleanliness in and around the garden is always helpful in reducing the disease menace. During the growing season any diseased plants which appear should be removed and burned, and after harvest, refuse from the garden should be raked up and either burned or buried, preferably away from the garden plot. It is unwise to leave exposed piles containing diseased, rotting vegetables in and around the garden. Manure and compost added to the garden should be free from such material.

USE OF DISEASE-RESISTANT VARIETIES

Varieties of vegetables resistant to certain specific diseases are gradually becoming available and may now be used to advantage, where they are adapted, in the control of a number of diseases. In utilizing them it should be noted that a variety resistant to one disease is not necessarily resistant to other diseases, and that certain types of resistance may vary in different localities.

PROTECTION AFTER HARVEST

Finally it is important to bear in mind that much loss from disease may occur in vegetables after they are harvested. Vegetables still require protection after they are removed from the soil. Only the soundest should be stored. Injuries from rough handling, frost, etc., must be guarded against and the storage quarters must be kept clean, well ventilated and cool if after-harvest deterioration from disease is to be kept to a minimum.

TABLE III.—SUMMARY OF CONTROL MEASURES FOR DISEASES AFFECTING SOME COMMON VEGETABLES GROWN IN ALBERTA

Vegetable	Disease	Symptoms and Signs	Principal Control Measures
Bean	Bacterial blights	Water-soaked, later brown spots on leaves, stems, pods and seeds.	Use seed from clean crops and resistant varieties when feasible.
	Anthracnose	Deep cankers on pods, dark spots on leaves, stems, pods and seeds.	"
	Mosaic	Mottling and distortion of leaves, stunting of plants.	"
Beet	Seed rot	Poor seedling stand.	Treat seed with dust fungicide, etc. (1).
	Damping-off	Poor seedling stand, collapsed seedlings.	Treat seed with dust fungicide, etc. (1).
	Cercospora leaf spot	Numerous small brown to gray spots with dark borders.	Treat seed with dust fungicide, sanitation, rotation, thinning; spraying with Bordeaux mixture (2) will control, but it is seldom warranted.
Cabbage and other crucifers	Damping-off	Poor stand, diseased roots and stem base.	Treat seed with dust fungicide, etc. (1).
	Black rot	Yellow V-shaped lesions from leaf margins, black veins.	Use disease-free seed or treat with hot water and a protectant (3).
Carrot	Sclerotinia rot	Rotted roots often with white mould producing black irregular bodies.	Grow resistant crops, e.g. corn, potatoes for several years. Clean, cool storage.
	Soft rot	Soft, slimy root rot, especially in storage.	Sanitation. Avoid wounding. Store in cool, well-ventilated quarters.
	Yellows	Yellowing of young and purpling of old leaves, roots inclined to be hairy, slender and rough with age.	Control insect vector (leaf-hopper) and weeds.
Celery	Late blight	Brown spots containing black specks on leaf blades and stalks.	Treat young seed (1 or 2 years old) (4), leave older seed untreated; sow in clean or sterilized soil; avoid crowding in seed bed; spray or dust seedlings (5), spray or dust plants after transplanting to the field (6).
Corn (sweet)	Seed rot	Poor stands.	Select sound seed, treat with dust protectant.
Cucumber	Mosaic	Mottling of leaves, and fruit, stunting and distortion.	Dust for insect control (aphids and other carriers), eradicate weeds, cut diseased plants and leave in position.
Lettuce	Sclerotinia rot	Stem rot, leaves collapse, leak water, fungus as on carrot.	Remove, destroy diseased plants early. Rotate with corn, potatoes, etc.
Onion	Neck rot	Bulb usually rots at neck, gray fungus with black bodies usually present.	Use colored varieties, cure thoroughly after harvest, store just above 32°F. with good ventilation.

Pea	Seed rot	Poor seedling stand.	Treat seed with dust fungicide.
	Ascochyta blight	Purplish to brown spots on leaves, stems or pods and base.	Use clean seed and practise rotation and sanitation.
	Powdery mildew	Whitish powder on stems, leaves, and pods dotted with black specks later.	Dust plants with fine sulphur or lime-sulphur (7).
	Root rots and wilt	Basal parts rotted or plant wilted or both.	Follow at least a three to four year rotation. Use resistant variety when possible.
Potato (8)	Early blight	Dry, brownish spots with faint concentric rings on leaves chiefly.	Spray with Bordeaux (2) or apply copper-lime dust when first disease is noticed and at 10-day intervals thereafter.
	Late blight	Irregular dark brown water-soaked areas on leaf and stem. Tubers may rot in field or storage.	As for Early Blight.
	Bacterial ring rot	Leaflets show rolling, yellowing and death. Tubers show internal darkening and a cheesy rot around vascular ring.	See (8) and also consult your nearest District Agriculturist; use disease-free seed and disinfect all tools, machinery and containers with formalin.
	Virus	Mottling, rolling, yellowing, etc., of leaves. Stunting of plants. Reduction in yield.	Use disease-free seed only. Rogue out diseased plants and spray or dust to reduce insect carriers (aphids and leaf-hoppers).
	Scab	Rough, corky, brown scabs on tubers.	Use clean seed or treat (8). Use resistant variety and rotate with legumes and grains.
	Rhizoctonia	Brown lesions at base of stems. Rolling of leaves. Black spots on tubers.	Use clean seed or treat (8). Rotate with legumes and grains. Avoid late digging.
	Set rot	Decayed sets. Missing hills.	Apply a protectant chemical such as Fermate after cutting sets.
Tomato	Late blight—leaf spot	Small grey-brown angular spots dotted with black specks.	Sanitation and rotation.
	Blossom-end rot	Blossom end of fruit sunken, flattened by dry leathery rot.	Supply water regularly and evenly. Provide ample phosphate and calcium. Avoid excess nitrogen.
	Mosaic	Mottling and malformation of leaves. Stunting of plant.	Plant disease-free seed in clean or sterilized soil. Handle plants, especially seedlings, infrequently. Wash hands with soapy water after contact with diseased material. Transplant only healthy plants. Control aphids. Eradicate weeds.

(1) "Damping-off" also affects all other roots crops and all plants under glass grown for transplanting. Water thoroughly not too often, allowing soil surface to become quite dry before each watering. (See section on "Seedling Protection", and University of Alberta Circular 26).

(2) Bordeaux mixture spray 4-4-40 (1 lb. copper sulphate, 1 lb. hydrated lime in 10 gals. of water).

(3) Hold cabbage seed 25 minutes in water 122°F. and seed of other crucifers 15 minutes; follow with a dust protectant when thoroughly dry.

(4) Treat 1 to 2 year old seed (enclosed in a muslin bag) for 2 or 3 minutes with constant agitation in a suspension of finely powdered calomel (1 oz. to 3 1/5 quarts water). Dry and sow.

(5) Spray with Bordeaux 4-4-40 (see 2) or dust with copper lime dust when plants are wet (20 parts monohydrated copper sulphate to 80 parts hydrated lime) beginning when plants are about ½ inch tall, and again after a week or 2 weeks.

(6) Spray with Bordeaux 4-2-40 (1 lb. copper sulphate, ½ lb. hydrated lime to 10 gals. water) or Burgundy mixture 4-5-40 (1 lb. copper sulphate, 1¼ lb. sodium carbonate (sal soda), 10 gals. water), or copper lime dust (see 5), beginning about 2 weeks after transplanting and then at weekly or ten-day intervals until shortly before harvest.

(7) A 60-40 mixture of air-slaked lime and fine dusting sulphur.

(8) See also University of Alberta Bulletin No. 46.

Insect Pests of Vegetables and their Control

BY

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Residents of Alberta are fortunate in that, here, comparatively few insects seriously menace gardens. In many years, the damage which these few cause is so slight that it hardly warrants the employment of control measures. In others, however, one or more of them may be present in unusually large numbers and necessitate some immediate action in order to prevent them from destroying an undue proportion of the particular plants on which they feed.

TYPES OF INSECTS AND GENERAL CONTROL MEASURES

Insects may be classified conveniently into groups that cause certain general types of damage to plants. The kind of mouth-parts associated with the insect usually indicates the type of damage to be expected.

Biting Insects

Examples of insect pests which bite and swallow pieces of leaves are potato beetles, flea beetles and various caterpillars. These are most readily controlled by applying a stomach poison to the leaf surface where feeding is taking place.

Suitable stomach poisons for home garden use are:

(1) *Arsenic,* as Paris Green, Calcium and Lead Arsenates. These compounds should *not* be applied to edible plants such as lettuce, spinach and celery, although the poison may be washed from solid, smooth surfaces such as tomato fruits.

(2) *Rotenone* (*Derris*) and *D.D.T.* are effective stomach poisons but are discussed more fully for their value as contact insecticides.

Sucking Insects

These insects have mouthparts resembling those of mosquitoes, and obtain food by sucking plant juices from leaves, stems or fruits. To this class belong such important pests as plant lice (aphids), leaf-hoppers, phyllids and true bugs. These cannot be controlled by stomach poisons, since they do not eat the *surface* part of the plant. The chief means of control is by compounds that are sprayed or dusted directly onto the bodies of the insects, and enter them as

a poisonous dust, liquid or gas. Such compounds are called *contact insecticides.*

(1) *Nicotine Sulphate* is one of the most widely used contact poisons. It is a black, tarry fluid which kills by releasing poisonous fumes when diluted with water and sprayed on plants during warm weather.

(2) *Rotenone* (*Derris*) is a yellowish powder that may be used as spray or dust.

(3) *D.D.T.* is a white powder with a long name (dichlorodiphenyltrichloroethane), and may be obtained for use as spray or dust, as outlined on the container in which it is purchased. The D.D.T. compounds obtainable for household or livestock use are prepared in a coal oil base and must *never* be used on plants.

Contact insecticides have certain advantages and disadvantages connected with their use. These are as follows:

1. Although these are the only effective poisons for insects with piercing mouths, they will also kill those with biting mouths.

2. Every insect killed by these, dies without further feeding, whereas, when stomach poisons are used, each insect *must* continue to feed on the vegetation for a short time in order to obtain a fatal dose.

3. Few have much lasting effect. Any insect which is missed at the time of application is, in most cases, not harmed in any way. It is very difficult to make certain that none will be missed, particularly in the case of those which congregate, as many do, on the under side of leaves.

On the other hand, once vegetation has been sprayed with a stomach poison, provided it sticks to either side of the leaf, this continues to kill all biting-mouthed insects for the rest of the season.

Cutting Insects

A series pest in home gardens is the insidious cutworm. He works at night, and often below ground level, leaving discouraging evidence of his revels when, in the morning, young plants are found lying on the ground with nearly severed stems, and a useless stump just about at the surface of the ground. Control measures require the employment of poisoned bait, and recommendations for the treatment are given in a later section.

Tunnelling Insects

Some vegetable crops (notably onions and cabbage family plants) may be seriously damaged by small maggots that tunnel or

burrow into the root and stem tissue below ground level, causing death or a severe set-back to the plant. These maggots are the larval stages of flies, and their control measures are outlined in a following section.

Slugs

Slugs are well-known garden inhabitants that enjoy a moist, dark environment. They feed by scraping off the surface of leaves or stems of low-growing plants. An effective control is by *metaldehyde*, applied as directed on the container. A mixture of one part anhydrous copper sulphate to ten parts of hydrated lime also may be used. This is dusted on the ground about the affected plants, shortly after sundown.

PREPARATION AND APPLICATION OF POISONS

Sprays

All stomach poisons and contact insecticides can be applied as sprays by employing the following directions:

(a) Paris Green and other Arsenical Poisons—2 teaspoonfuls to 1 gal. of water or 1 oz. to 5 gals. In either case it is advisable to add an equal weight of lime to the poison before mixing. This is essential if beans are to be sprayed; otherwise they may be badly "burned".

(b) Derris is usually sold on a 5% Rotenone-content basis. At this strength, use 2 oz. to 1 gal. of water.

(c) D.D.T.—Use only a 50% Wettable Powder preparation, stirring ⅓ oz. of this mixture into 1 gal. of water.

(d) Nicotine Sulphate—Stir ¼ oz. or 2 teaspoonfuls into 1 gal. of water. Its killing power is improved by dissolving ½ oz. of soap in the water.

Application of Sprays: For small gardens, a "fly-sprayer" is fairly satisfactory, though some difficulty may be experienced in reaching the under-side of many leaves when a contact insecticide is being applied. A "Compressed Air", or a "Knapsack", sprayer (costing about $15 and $30 respectively) is almost a necessity for spraying in larger gardens.

Dusts

All poisons which are obtainable in powder form can be applied as dusts by following these simple directions:

(a) Paris Green and other Arsenical Poisons—Mix 1 lb. of the poison with about 12 lb. of any fine dust, such as hydrated or air-slaked lime, talc, gypsum or flour.

(b) Derris—Do not mix derris or rotenone with lime, but mix thoroughly with talc, gypsum or flour at the rate of 1 lb. derris to 3 lb. of the "carrier". Derris dust usually can be purchased ready to use.

(c) D.D.T.—This usually is sold as a 3% "nonwettable" dust, ready mixed for use.

Application of Dusts: For a very small plot, dusts may be applied by shaking through a bag made of cheesecloth or burlap, or through a perforated tin can. Small and quite efficient dust guns cost about $1.50, and a larger hand duster, using a rotary fan, may be purchased for about $15.00. Dust when there is moisture on the plants if practicable, but do not apply during strong winds.

CONTROL OF SOME IMPORTANT PESTS

Insects Attacking Most Garden Plants

Cutworms: The damage caused by these insects already has been described. The most common pest of our gardens is the Red-backed Cutworm. The young caterpillars emerge from overwintered eggs in late April, and feed until mid-June, by which time they are full grown, and will be from 1 to 1½ inches long.

The commonest control is by means of poisoned bait. This involves mixing an arsenical poison (preferably Paris Green) with bran and a molasses-water solution, or bran and light grade motor oil. One-half lb. Paris Green, 20 lbs. bran, 1 qt. molasses and 2½ gals. water is the basis for the first mixture, whereas the oil base preparation is made up of ½ lb. Paris Green, 2 qts. motor oil and 25 lbs. bran. The oiled bait will withstand weathering better and thus retain its poisonous quality longer on the ground, but it is less attractive to the caterpillars.

Cutworm baits should be scattered on the ground surface near the plants that are to be protected. Do this about sundown on a warm evening, and preferably when the soil surface is damp.

Individual plants may be protected by encircling them with plant bands or tin cans from which both ends have been removed.

Plant Lice (Aphids)—There are many species of aphids. Many can feed only on a certain vegetable or type of vegetable plant. They become especially numerous during unusually warm summers when conditions are ideal for the development of several generations. They overwinter as hard-shelled eggs, and after hatching, wingless females give birth to live wingless daughters, and so on through several generations. When a colony becomes overcrowded, winged individuals are produced. These will fly to new locations

and begin new colonies. In autumn male insects are produced which mate with the females, whereupon the eggs for over-wintering are laid.

Control is secured by spraying with Nicotine Sulphate, or Derris. The latter can also be applied as a dust.

Flea Beetles: When young plants, particularly swede turnips, radishes, beans and vine crops, show tiny round holes eaten from their leaves, that is a signal that flea beetles are actively present. These tiny jumping beetles start feeding as soon as the young seedling leaves appear.

The most effective control is by dusting with Derris or D.D.T., although hydrated lime or fine ashes sometimes are used as repellents.

Insects Attacking the Cabbage Family and Onions

Root Maggots: The damage caused by these pests is mentioned previously in this section. They overwinter in the pupal stage in soil, and emerge as flies quite early in May. Eggs are deposited on the plan stem or in the soil nearby. The newly hatched maggot eats its way into the stem or root tissue and may cause serious damage.

Corrosive sublimate (Mercuric chloride, or bi-chloride of mercury) is the poison most generally used for control. It is a deadly poison if ingested, and should be so treated, although it will not injure the hands. It is very corrosive to metals, so should be handled in wooden, glass or earthenware vessels. After use, the hands and empty containers should be thoroughly rinsed in order to remove all traces of the poison. Dissolve 1 oz. of poison in 10 gal. of water, and apply about ½ cupful to each cabbage or cauliflower plant. For onions, radishes and swede turnips, gently pour a stream of the solution onto the plants along the row, at the rate of 1 to 1½ gal. per 30 ft. row.

Napthalene flakes, at ⅓ handful to each plant, or 1 handful per 4 ft. row, has been found to reduce damage from an infestation.

Mechanical control may be affected by wrapping plant stems at transplanting time with newspaper, or slipping "collars" of tar paper (2 in. in diameter) about the plant stems.

Cabbage Butterfly: The well-known green caterpillars emerge from eggs laid on plant leaves of cabbages, swede turnips, cauliflower, broccoli, and Brussels sprouts. These are deposited by the common white butterfly.

Any stomach poison is effective, so long as control is not delayed until it is difficult to reach the caterpillars. Of these, the arsenicals, are by far the cheapest, but as soon as cauliflowers are showing

curds ("heads"), Derris only should be used, since it is non-poisonous to humans. If arsenicals are used on cabbages, the outer leaves should be removed before the heads are stored or eaten.

Turnip Beetles: These are red-and-black beetles, somewhat resembling the potato beetle. The larval stage is a black grub and both larvae and adults feed upon cabbage family plants.

Control by spraying or dusting as for the cabbage butterfly caterpillar, and rotate crops if the infestation is serious.

Insects Attacking Potatoes

Potato Beetles: These insects are well known in Southern Alberta, but are not so troublesome in the Edmonton area. When the soil is quite moist at freeze-up, and there is little snow before severe frosts, the insects are held in natural check. The coral-pink larvae (grubs) eat and grow very rapidly indeed, and if control is delayed for only a few days, the potato tops may be completely stripped of leaves.

Fortunately, control is simple and effective by means of sprays or dusts with arsenicals, Derris or D.D.T. Repeat the treatment in order to make certain that new growth is protected and all new hatches killed.

Aphids: These have been discussed previously, but they are particularly serious on potatoes as transmitters of leafroll, mosaic and other virus diseases.

Control by spraying with D.D.T. Also spray cultivated rose bushes as soon as aphids are noticed on them, for the rose is the "host" plant for overwintering potato aphids.

Psyllids: These small, flat, green insects attack the under-side of potato leaves in late spring and early summer. They overwinter on tomato plants in greenhouses, and escape to potato plants in the spring. Their attacks cause a disorder known as "potato yellows".

Control as for aphids with D.D.T. spray or dust.

Wireworms: These hard-shelled, orange-yellow grubs are larvae of small black beetles. They may take 4 to 12 years to reach their full growth of about one inch. They tunnel through potatoes, and may attack all root crops as well. Their injury may lead to fungus or bacterial infections.

Every effort should be made to grow potatoes in a part of a garden in which wireworms appear to be the least numerous. Wireworm populations can, however, be greatly reduced by treating the

soil with *crude* naphthalene. This material is produced in British Columbia and it sells in Alberta at about 5c per pound, in 100 pound lots.

Large lumps should be crushed before it is spread over the soil surface at the rate of 700 to 750 pounds per acre. This must be done during the hottest part of the year, and it must then be dug or ploughed in to a depth of 7 inches, after which it must be thoroughly mixed into the soil with a fork or a cultivator.

Though this may appear to be a very expensive method, it can be expected that a single application will greatly reduce the wireworm population for the next 10 or 12 years.